AN INDEX MAPPING-BASED DEEP TRANSFER LEARNING APPROACH FOR VIOLENT CRIME PREDICTION

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LIST OF ABBREVIATIONS

Acronyms	Full Meaning
ANN	Artificial Neural Network
API	Application Programming Interface
ASP	Active-X Server Pages
ASM	Attributes Selection Measures
BP	Back Propagation
CC	Control Server
CNN	Convolutional Neural Network
CPTED	Crime Preventions Through Environmental Design
CSS	Cascading Style Sheet
DB	Database
DBSCAN	Density Based Spatial Clustering Application with Noise
DEEPTRA	Deep Transfer learning
DL	Decision Learning
DNN	Deep Neural Network
DT	Decision Tree
DTL-NN	Deep Transfer Learning Neural Network
EE	Enterprise Edition
EJB	Enterprise Java Beans
FBI	Federal Bureau of Investigation
FCT	Federal Capital Territory
GPS	Global Positioning System
GUI	Graphics User Interface
HTML	Hyper Text Markup Language
HTTP	Hyper Text Transfer Protocols
IDE	Integrated Development Environment
IoT	Internet of Things
JDBC	Java Database Connectivity

JS	JavaScript
JSON	JavaScript Object Notation
JVM	Java Virtual Machine
KDE	Kernel Density Estimation
KNN	K- Nearest Neighbor
LAMP	Linus Apache MySQL and PHP
ME	Mobile Edition
ML	Machine Learning
MLLib	Machine Learning Libraries
MLP	Machine Learning Programs
NLP	Natural Language Processing
NoSQL	No Structured Query Language
OCR	Optical Character Recognition
PCA	Principal Components Analysis
PHP	Hyper Text Preprocessor
RDBMS	Relational Database Management System
SE	Standard Edition
SOCP	Second Order Cone Programming
SQL	Structured Query Language
SUS	System Usability Scale
SVM	Support Vector Machine
TD-IDF	Term Document and Inverse Document Frequency
UCPS	Ubiquitous Crime Prevention System
VVT	Voice to Text
WAMP	Windows Apache MySQL and PHP
XAMPP	Cross Platform Apache MySQL PHP and Perl
XML	extra Markup Language

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A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF DOCTOR OF PHILOSOPHY (Ph.D) IN COMPUTER SCIENCE IN THE DEPARTMENT OF COMPUTER AND INFORMATION SCIENCES, COLLEGE OF SCIENCE AND TECHNOLOGY, COVENANT UNIVERSITY, OTA.

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ABSTRACT

Crime has been with us from time immemorial and impacts negatively on the quality of life of citenzery and the general health of a nation. Different approaches have been used in the previous studies for violent crime prediction to aid predictive policing, making conventional policing more efficient and proactive. The violent crime rate in Nigeria has been on the continual increase. There are dearths of state-of-the-art measures like the predictive policing approach for violent crime prediction in Nigeria. The existing controlling and preventive measures for tracking and controlling violent crime are not sufficient. The violent crime predictive models in the previous studies do not have sufficient features to predict violent crime types and time-slot of violent crime occurrences. More so, violent crime occurrence prediction is nearly impossible when there is insufficient dataset. Therefore the aim of this study is to develop an improved predictive model for violent crime prediction using an index mapping-based deep transfer learning approach with a view to increasing the predictive accuracy of violent crime prediction in Nigeria. The sources of data for this study are from historical violent crime records of Nigerian Police, and online reported violent crime data. As a prelude to generating training data, cleaning of data and relevant feature selection of violent crime dataset were performed. Consequently the predictive model developed during the empirical study was trained on IBM Watson Machine Learning studio. The model consists of four layers: data collection, features extraction, spatio-temporal violent crime prediction premised on index mapping-based deep transfer learning, and violent crime hot spot visualizer layer. The evaluation experiment was conducted through benchmarking with the existing approaches using accuracy, semantic precision, and recall as well as F-measure metrics with the use of confusion matrix. The violent crime prediction model evolved in this study delivers a predictive accuracy of 92.53% across the six violent crime dataset used. This result showed that an index mapping-based deep transfer learning model developed outperformed other Machine Learning models used in the previous studies. In addition, the proof-of-concept web-based application for reporting and alerting violent crime developed was also evaluated through a system usability scale survey with a result of 85.28%, which represent usable system with good usability rating score. The study therefore serrves to benefit the citizens of Nigeria by alerting them of violent crime hotspot areas in the country, and also would enable police authority develop violent crime prevention strategies that could mitigate spate of criminal activities in the country.

Keywords: Convolutional Neural Network, Deep Learning, Index mapping, Recurrent Neural Network, Transfer Learning, Hot spot, Violent Crime Prediction.

ACCEPTANCE

This is to attest that this thesis is accepted in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy (Ph.D) in Computer Science in the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Nigeria

Mr. John A. Phillip ____________________________

(Secretary, School of Postgraduate Studies) Signature and Date

Prof. Obinna C. Nwinyi ____________________________

(Ag. Dean, School of Postgraduate Studies) Signature and Date

DECLARATION

I, **FALADE Adesola Muritala (13PCG00484)**, declare that this research work was carried out by me under the supervision of Prof. Ambrose A. Azeta and Dr. Aderonke A. Oni of the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Nigeria.

I attest that this thesis has not been presented either wholly or partially for the award of any degree elsewhere. All the sources of the data and scholarly information used in the thesis were duly acknowledged.

FALADE, ADESOLA MURITALA ______________________________

Signature and Date

CERTIFICATION

We certify that the thesis titled **"An Index-mapping based Deep Transfer Learning Approach for Violent Crime Prediction"** is an original research work carried out by **FALADE, ADESOLA MURITALA (13PCG00484)**, in the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ogun State, Nigeria under the supervision of Prof. Ambrose A. Azeta and Dr. Aderonke A. Oni. We have examined and found the work acceptable as part of the requirements for the award of a degree of Doctor of Philosophy (Ph.D) in Computer Science.

Prof. Ambrose A. Azeta ________________________

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DEDICATION

This research study is dedicated to the glory of Almighty God, the Alpha and the Omega, the light of the World who granted me the grace to start and finish the Ph.D programme successfully. Mighty God, I thank you.

Also, to the loving memory of my beloved parent who took care of me from childhood. May their gentle souls rest in the bosom of the Lord.

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